Regional Interpretation - Great Plains

The Great Plains region includes the greatest expanse of grasslands in the United States. The region boundaries in Figure 1 include the tallgrass, mixed grass, and shortgrass prairies. Although grasslands are the dominant vegetation type, shrub, forest and woodland vegetation also exists throughout the region. The northeastern portion and central area of New Mexico support more species associated with shortgrass. The Southwestern Tablelands situated in central New Mexico supports juniper-scrub-oak-grass savannahs. The grasslands in the Great Plains are associated with high productivity due to the generally reliable summer precipitation, a long growing season, and deep, fertile soils. Productivity is greatest in the eastern region (tallgrass prairie), followed by mixed grass, then shortgrass prairie. Lands that were formally grasslands, now farmed are some of the most fertile cropland in the U.S. and the world. When Lewis and Clark first visited the Great Plains in 1805, they observed and recorded the abundant wildlife which included large herds of bison, and elk. Lewis and Clark were in awe as to the abundance and diversity of wildlife and vegetation. Today, much of this land has been converted to rain-fed and irrigated crop production. The rangeland that remains uncultivated typically occurs on areas that are marginally or not suitable for crop production (Figure 2).

Figure 1. Broad Regions Described in the Interpretations.

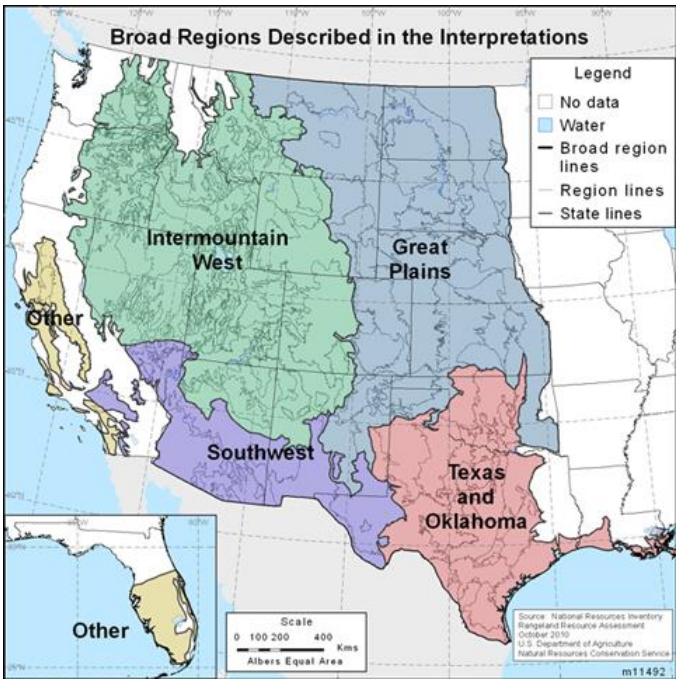
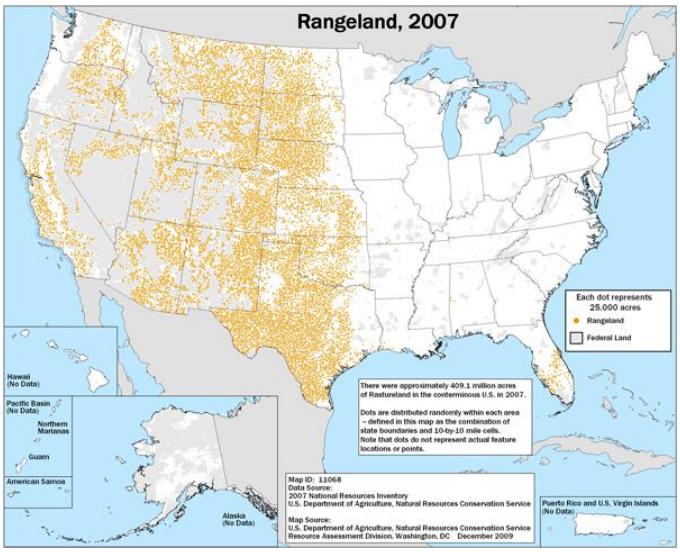


Figure 2. Acres of Non-Federal Rangeland, 2007.



Settlement of the Great Plains began after Louisiana Purchase (1803) and the Lewis and Clark expedition (1806). By the mid 1800's settlement expanded rapidly with the advent of railroads and the Homestead Act of 1862. Adequate rainfall and abundant arable land attracted settlers. However, the Great Plains are susceptible to periodic droughts which caused farms to be abandoned, causing economic recessions and turning fields into dry wastelands. This happened several times in the 1800s and early 1900s in the mid- and southern parts of the Great Plains with the worst dust bowls occurring in the Depression years and "Dust Bowl" of the 1930s (Hurt 1981). Major droughts occur approximately every 20 years (1890s, 1910s, 1930s, 1950s, and 1970s). The 1990s witnessed yet another period of serious drought conditions, especially in the southern Great Plains with some of the hottest and driest conditions that this region has ever experienced.

Soil and Site Stability

Soil and site stability is predominantly stable with none-slight or slight-to-moderate departure from reference conditions (Figure 3). In eastern Colorado, some areas showed 10-20% of the rangeland acres at moderate or greater departure from reference conditions. This area supports the drier more fragile fringe of the short grass prairie and subsequently is not as resilient to disturbance factors. Grassland vegetation in the Great Plains is comprised largely of overlapping cover of grasses and forbs. The prairie vegetation typically provides adequate foliar and ground cover and resilience to sheet and splash erosion. Soils that develop with grassland vegetation, on the average, have well-developed soil surface layers, that are relatively high in organic matter, support high root biomass, and are host to a high diversity of soil microorganisms that contribute to high aggregate stability. High aggregate stability is associated with greater soil stability and hydrologic function. If sites are

subjected to degradation, vegetation cover rebounds relatively quickly when rainfall is adequate. Since vegetation cover and productivity of grasslands in the Great Plains can be high compared to other rangeland types throughout the U.S., other environmental attributes such as bare ground and inter-canopy gaps are largely negligible.

Hydrologic Function

In the Great Plains, hydrologic function is predominantly at potential (none-to-slight or slight-to-moderate) according to reference conditions for each ecological site (Figure 4). Corresponding to the discussion of vegetation cover with soil and surface stability, grassland vegetation buffers the effects of rainfall, accelerated runoff, and subsequent erosion. In eastern Colorado, a greater proportion of the rangeland acres (20-30%) have moderate or greater departure from reference conditions. The intersection of South Dakota and Montana also shows moderate departure for 10 to 20 percent of the acres. These areas support the drier aspect of the shortgrass prairie and potential for higher amounts of bare ground. Hydrologic function is determined from 10 indicators (rills, water flow patterns, pedestals, bare ground, gullies, soil surface resistance to erosion, soil surface loss or degradation, plant community composition and distribution relative to infiltration and runoff, compaction layer, and litter amount) that interact and are correlated with each other. For example rills, gullies, and unstable water flow channels and patterns are exacerbated by changes in plant composition, increased bare ground, litter distribution and amount.

Biotic Integrity

Of the three rangeland health attributes, biotic integrity in the Great Plains is generally rated as having the greatest departure from reference conditions (Figure 5). One of the main contributing factors is that invasive native and exotic species are present and increasing throughout many native grass stands. Figure 6 shows the collective extent and presence of non-native plant species. Annual exotic grasses and forbs are present throughout the Great Plains. Annual brome grasses (*Bromus* spp.; Figure 7) are ubiquitous in this region. In particular, cheatgrass (*Bromus tectorum* L.) (Figure 8) is especially widespread. Additionally, perennial sod-forming grasses Kentucky Bluegrass (*Poa pratensis* L.) and Canada Bluegrass (*Poa compressa* L.; Figure 9), thistles (*Cirsium* spp.; Figure 10), and leafy spurge (*Euphorbia esula L.*; Figure 11) are prominent in the eastern portion of this region. As these invasive species increase, native plant species diversity is decreasing (Ogle et al. 2003, Pritkel et al. 2006, Mack et al. 2007, Davies 2011, Fink and Wilson 2011).

Invasive species such as Kentucky bluegrass and smooth brome are causing considerable concern in the Northern Great Plains, especially in North Dakota, South Dakota, and Nebraska (Grant et al. 2009, DeKeyser et al. 2013, Toledo et al. *in review*). Although biotic integrity is rated largely none-to-slight and in some areas slight-to-moderate, this metric does not exclusively represent invasive species, and the impact of invasive species on the evaluation of the attribute is further limited by the way that it is estimated for the NRI: the median rating for the indicators associated with each attribute, instead of

the preponderance of evidence is used. Although biotic integrity does include the invasive plants indicator, eight other indicators are also included in determining the median : functional/structural groups; three soil related indicators (soil surface resistance to erosion, soil surface loss or degradation, and compaction layer); and four indicators related to overall conditions of the plant community (plant mortality/decadence, litter amount, annual production, and reproductive capacity of perennial plants). Therefore, if the majority of the biotic integrity indicators show less departure from expected than the invasive species indicator, the attribute will reflect a rating showing less departure than the individual invasive species indicator rating. For this reason, we have included maps (Figures 6-11) showing the extent and percent of non-Federal rangeland occupied by some of the invasive species in the Great Plains.

Rangeland specialists are aware of other changes that are associated with the increase of Kentucky bluegrass, smooth bromegrass, and exotic annual grasses. For example, as these invasive species increase: 1) diversity of native forb and grass species decreases (Cully et al. 2003; DeKeyser et al. 2009; Miles and Knops 2009a); 2) ecosystem functions related to nitrogen cycling and soil organic carbon cycles are disrupted (Wedin and Tilman 1990; Wedin and Pastor 1993; Wedin and Tilman 1996; Hendrickson et al. 2001); 3) seasonal forage quantity and quality shifts occur (Toledo et al. *in review*); 4)Infiltration rates are altered due to change in plant root morphology and the development of a thatch layer (Harivandi 1984; Taylor, 1982; Hurto et al., 1980) and 5) reduction or alteration of vegetation diversity that provides quality habitat for certain wildlife species (e.g., native pollinators) (Bommarco et al. 2010; Moron et al. 2009; Vanbergen and Initiative 2013).

Figures 3-5. Non-Federal Rangeland Where Soil and Site Stability, Hydrologic Function, or Biotic Integrity Show at Least Moderate Departure from Reference Conditions. (Source: Rangeland Health Table 2)

Figure 3. Soil and Site Stability

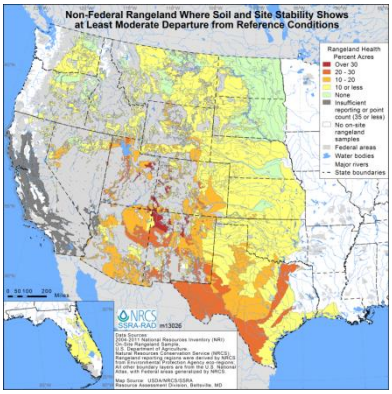


Figure 4. Hydrologic Function

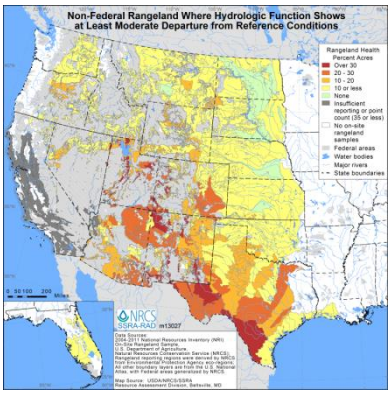


Figure 5. Biotic Integrity

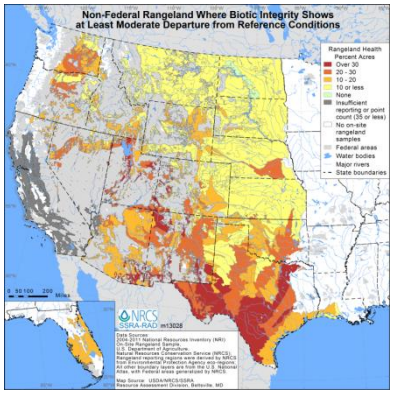
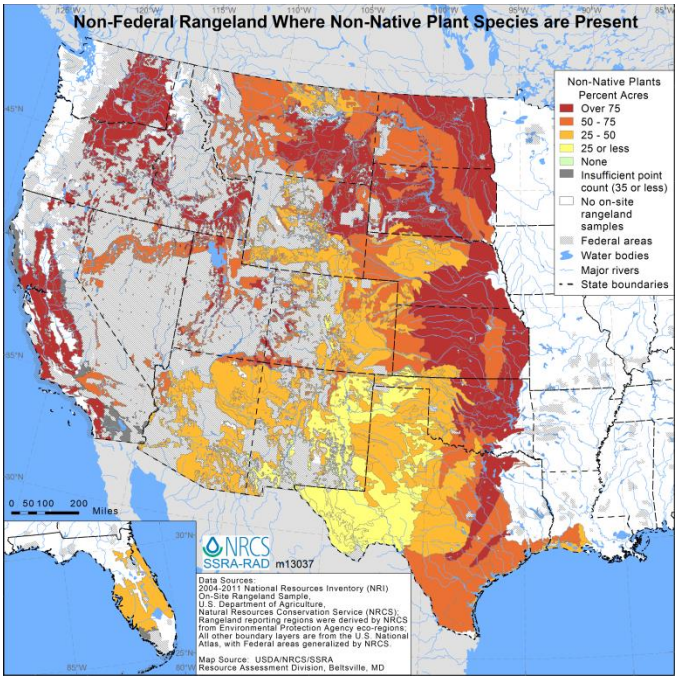


Figure 6. Non-Federal Rangeland Where Non-Native Plant Species Are Present. (Source: Non-Native Plant Species Table 2)



Figures 7-8. Non-Federal Rangeland Where Annual Brome Species and Cheatgrass Are Present. (Source: Non-Native Plant Species Tables 1, 3, and 5)

Figure 7. Annual Bromes

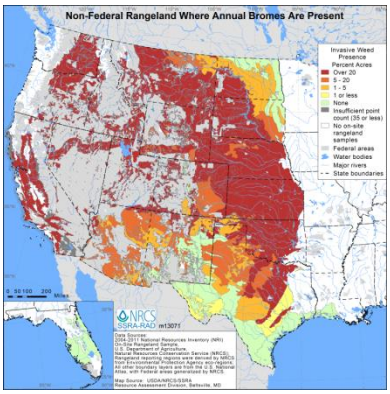
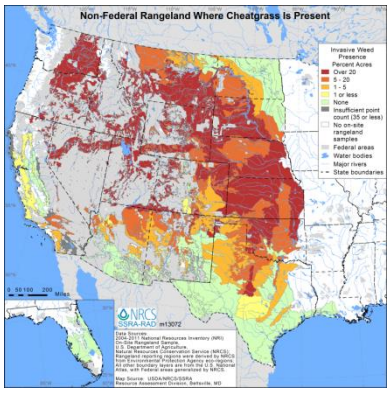
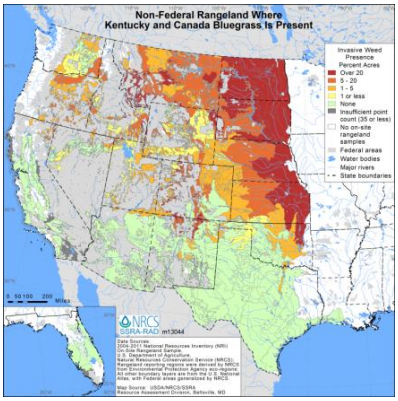


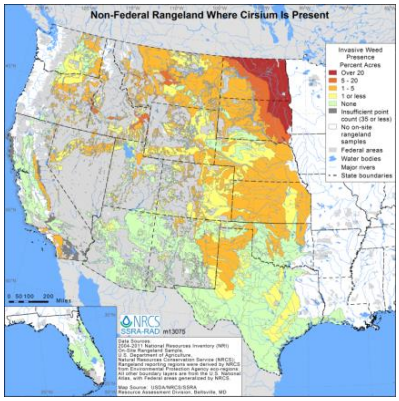
Figure 8. Cheatgrass

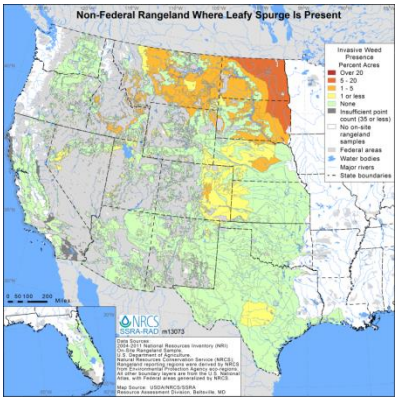


Figures 9-11. Non-Federal Rangeland Where Kentucky Bluegrass and Canada Bluegrass; Circium; or Leafy Spurge Are Present. (Source: Non-Native Plant Species Tables 1, 9, 17, and 19)

Figure 9. Kentucky and Canada Bluegrass Figure 10. Circium Figure 11. Leafy Spurge







More Information

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